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Ms. Magalie Roman Salas,
Secretary
Federal Communications Commission
445-12th Street, SW,
Room TW-B204
Washington, DC 20554

Re: GN Docket Number 00-185

Dear Ms. Salas:

Please replace the filing initially submitted in December, 2000 with this draft for consideration in docket number 00-185.

The filing, like the earlier version, represents the views of its authors Hugh Carter Donahue, Ph.D., Shawn O'Donnell, Ph.D., and Josephine Ferrigno-Stack, M.A.

Neither the Annenberg Public Policy Center nor the Annenberg School for Communication of the University of Pennsylvania take official or formal views in such inquiries.

Thank you for your attention and consideration.

Sincerely,

Hugh Carter Donahue, Ph.D

18 April 01

Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	
Inquiry Concerning High-Speed	)	**GN Docket No. 00-185**
Access to the Internet Over	)	
Cable and Other Facilities	)	

Comment
On Notice of Inquiry

Submitted: April 18, 2001

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I. INTRODUCTION

As the Federal Communications Commission (Commission, FCC) addresses policy for high-speed Internet access, the authors of this report respectfully recommend 1.) monitoring of and 2.) mandatory disclosure of high-speed service quality (quality of service, QoS) as the surest paths toward realizing the Commission's goal of one national policy framework with equitable regulatory obligations for all high-speed Internet services articulated so forcefully in the Notice of Inquiry (GN Docket No.00-185, Notice, paragraph 4).

By monitoring, we recommend that the Commission articulate a specific policy for gathering and analyzing measures of such high-speed Internet service characteristics as cost, performance, down-time, privacy, security and customer service. Data on, and audits of, the less technical aspects of service quality (adherence to privacy and security policies, access to third-party

arbitration of disputes, or the responsiveness of customer service) can complement hard data on network performance to provide a clear picture of a provider's service offering.

Monitoring the norms suggested above would provide a baseline standard by which the Commission could assess the status of competition in the high-speed Internet marketplace.

A performance monitoring program for high-speed networks also enables the Commission to address the asymmetry of information in consumer markets: service providers enjoy a great advantage in access to—and in skills to interpret—information about the services they offer

Specifically, we suggest a system of hardware and software agents to measure the performance of the network from points at which outsiders have access to the network—namely, at the user's computer. We recommend packet level observations and 'holistic,' application-level tests.

By instituting a policy of mandatory disclosure of high-speed access service quality, we propose that the Commission impel high-speed Internet service providers to furnish the Commission with empirical measures of cost, performance, down-time, privacy and customer service as well as data on, and audits of, the less technical aspects of service quality - adherence to privacy policies, access to third-party arbitration of disputes, or the responsiveness of customer service. We recommend 1.) monitoring and 2.) disclosure of high-speed service quality as timely policy as the Commission administers the shift to a market-based commercial communications system from existing regulatory regimes.

The monitoring and disclosure of high-speed service quality enables the Commission to realize its policy of competitive neutrality among telephone, cable and wireless providers with the least intrusive regulatory policy upon the soundest bases in information. This approach, we propose, acknowledges the *sui generis* attributes and artifacts of distinct communication platforms as it provides the empirical data to effect a national framework.

If the Commission were to adopt such an empirically based monitoring policy, new value-added information enterprises could emerge to conduct the monitoring to supply the data to the Commission. This proposal does not require that the Commission undertake such data collection itself.

II. HEURISTIC RATIONALE

Central to this recommendation is the normative first amendment goal that anyone using the Internet or posting a site or information to the World Wide Web (Web) be able to publish and to access information over high-speed networks regardless of what ISP/telco/cable, cellular or wireless company is providing connectivity. Using technical means to privilege some types of information over others undermines the citizenry's first amendment rights. Access for all citizens to the widest sources of information is vital for democracy.

While the Notice necessarily focuses on regulatory policy for high-speed access to the Internet over cable and other facilities, the normative goal of robust first amendment freedoms of publication and information gathering necessarily shapes Commission high-speed policy. For all the differences between libertarian and majoritarian approaches toward free speech the common ground between these rival first amendment schools is the right of expression. Arguably, each distinct articulation is cast in highest relief in Buckley v. Valeo (424 U.S. 1, (1976), which propounds the unfettered ability of speakers, and in Red Lion (395 U.S. 390 (1969), which upholds an access right to information.

Our proposal of monitoring and disclosure of service quality encourages the Commission to establish this monitoring system in order to have empirical data to alert the Commission to invidious exclusions from publication and access through abuses of market power due to control of high-speed networks to the detriment of first amendment freedoms. Monitoring of and mandatory disclosure of high-speed service quality do not place speakers at an advantage over listeners.

Monitoring of and mandatory disclosure of high-speed service quality do not constitute or impel equality of speed, cost, reliability, restitution, among other factors, in high-speed communications. We recognize wide ranges of consumer preferences, distinct communications platforms, marketplace realities and dynamics, and regulation.

Instead, the monitoring and mandatory disclosure approach enables the Commission to evaluate systemic activity in high-speed networks on the fullest bases of information in order to reach policy for the *sui generis* attributes of distinct high-speed media, to recognize unabridgeable first amendment freedoms, including a right to be accessed, for all speakers across all high-speed media should the Commission choose such a course of action.

The Commission will then be able to address how organizations controlling high-speed networks systemically deal with expression under market-based and regulatory regimes. In these ways, monitoring and disclosure of high-speed service quality constitute structural regulation.

III. ADVANTAGES FOR REGULATORS

To date, the Commission has been wary of mandating access to high-speed networks with policies similar to narrowband access requirements. Instead, the Commission has articulated and followed a 'wait and see' policy toward high-speed cable access with repeated assertions that it wishes to evaluate the ways in which consumers substitute one high-speed technology for another before it imposes access regulation on a specific high-speed technology. Indeed, a significant responsibility of respondents to the Notice is to address the points of access and substitution across a number of technologies and variety of regulatory classifications. This section addresses pertinent portions of the Notice with respect to this monitoring and disclosure system.

Monitoring and mandatory disclosure of high-speed service quality advance Commission consideration of substitution through evaluation and analysis of the pertinent performance data (paragraph 4) from varieties of facilities-based competitors.

Monitoring and mandatory disclosure of high-speed service quality enable the Commission to sustain and implement regulatory restraint regarding emerging services, and they equip the Commission to contribute regulatory stability in dynamic markets based on performance measures (paragraph 2).

Through this explanatory power, monitoring and mandatory disclosure of service quality provide the Commission a fuller basis of information with which to spur competition, innovation and deployment of high-speed services (paragraphs 14, 26).

By measuring qualities of service, monitoring enables administration of the new economy with greater specificity on the bases of empirical performance data. The performance data would assist regulatory decision making in complex, uncertain market conditions. The information would help to illuminate gatekeeper effects. It would provide ready comparability between the United States and European Community for conversation and deliberation with U.S. policy makers. The tool could also be useful in investigating such key U.S. policy concerns as collusive arrangements, abuses of dominant position and the competitive advantages and disadvantages encountered by firms lacking market power.

Whether open access is provided voluntarily or under regulatory requirements, a service monitoring program will assist regulators in fulfilling their responsibilities. Should open access be provided on a voluntary basis, monitoring data will indicate whether unaffiliated ISPs are receiving a level of service quality that allows them to compete with affiliated ISPs. A healthy, competitive market is, after all, a sign that regulation is not necessary. And should open access be mandatory, monitoring will insure that facilities carriers provide access on terms specified by law (paragraph 20).

Monitoring will allow consumers and unaffiliated ISPs to judge whether facilities providers are delivering the QoS promised in service level agreements (SLAs.) A process for offering and verifying QoS-guarantees to consumers and service providers will encourage the development of new, QoS-dependent services. Without independent monitoring of QoS, such service innovations will be slow to develop. Also, by comparing monitoring data for various unaffiliated ISPs, regulators will be able to determine whether those ISPs are being offered non-discriminatory access to consumers on facilities-based providers' networks (paragraph 29).

For the immediate questions of mandated access to the cable plant, monitoring and mandatory disclosure of service quality address the broad range of options concerning forbearance and rule making for which the Commission seeks comment at the close of the Notice. They do so by providing evidence as to whether market forces are or are not working (paragraph 50), by constituting bases for Commission action or sustained vigilant restraint (paragraph 51), by informing rulemaking and classification across technology platforms and other high-speed services (paragraphs 52 ,53 ,54 and 56), and by clarifying the ways in which facilities based competition impels or obviates rulemaking (paragraph 55).

And, broadly, monitoring of and mandatory disclosure of high-speed service quality would contribute to Commission articulation of "a new legal and policy framework" (paragraph 24) due to the explanatory power of the analysis to clarify comparatively across communications platforms whether or not telecommunications and information services remain workable rubrics or are now anachronistic.

IV. BENEFIT TO CONSUMERS

Section 706 of the Telecommunications Act sets out the Commission's mandate to protect the consumer while encouraging an open, market-driven high-speed environment. The proposed monitoring and disclosure program would provide pertinent and useful Quality of Service information to the Commission while also being a helpful tool for the average high-speed Internet access consumer. The information gathered from the monitoring system could be passed onto consumers to arm them with sufficient knowledge to be educated high-speed consumers in addition to providing a model of a value-added service that could contribute to market competition across a range of telecommunications markets.

As the complexity of telecommunications services grows, and as the mix of services demanded by the average consumer expands, it will become increasingly difficult for average consumers to make informed decisions about every service they use. For example, the currently developing model of ubiquitous, ad hoc wireless networks assumes that, as consumers change location, they will constantly be offered services by competing, locally-run wireless micronetworks. The ability of the consumer to judge which offer to take will depend on how successfully system designers can create an easy-to-understand presentation of the options available. Even if software agents are ultimately assigned the responsibility for weighing the offers made by various service providers, the user interface for configuring the network service "purchasing agent" will have to pose the options in readily comprehensible format. So a service that can be trusted to provide up-to-date assessments of the quality of service offered by diverse networks will be in ever greater demand as the variety of options for personal communications multiplies.

Open access policies, whether affirmative or restrained, are more likely to contribute to public policy goals if they are based on measurements of the quality of service offered to competing ISPs. That is, it is desirable to test the quality of the connections offered over high-speed networks to determine if non-discriminatory access is being offered to competing service providers, whether carriers are providing interconnection voluntarily or under regulatory requirements.

The information gathered by the monitoring would contribute to a market-based solution to information inequities between the consumer and the provider of high-speed services. We believe that for market-based solutions for high-speed service deployment to succeed transparency is the key ingredient. Monitoring will provide this transparency. These information-rich monitoring requirements are technology and bit neutral, easy for high-speed providers to implement and simple for consumers to understand.

- Cost - a detailed description of the cost of the service and the billing period, and the manner of payment
- Performance - which spans a number of dimensions, including
  - Speed - a specified speed or speed range that will be provided to the customer
  - Latency – end-to-end delays
  - Jitter – variability in latency
  - Reliability - guarantees of network reliability
- Down-time - percentage of average down-time and a guarantee of reimbursement for large amounts of down-time that a customer experiences
- Privacy policies – implementation of published privacy guidelines as certified by a third party
- Customer services - list of customer services contact information, hours of operation and guarantees of speedy service.
- Restitution - amount of money to be returned in cases of network problems and/or lack of service.
- Third-party arbitration - name and contact information where customers can lodge complaints against a high-speed access service provider.

The Commission's mandate regarding high-speed access services calls for rapid deployment of high-speed services Internet services in equitable manner to all Americans. Senator Conrad Burns of Montana stated, "The pace of broadband deployment to rural America must be accelerated for electronic commerce to meet its full potential...I am convinced that the proper use of Section 706 of the Telecommunications Act can help to bring these advanced data services to underserved areas." (Statement of Senator Conrad Burns, Senate Communications Subcommittee Hearing on Broadband Deployment in Rural America, March 28, 2000). To that end, monitoring of high-speed access roll out has begun in a preliminary fashion (Second Report FCC 00-290).

Monitoring and disclosure of service quality, along the lines we propose here, seeks to enhance previous FCC monitoring and reporting requirements and to provide fundamental data on high-speed services to both the Commission and the consumer. It is only through accurate and comprehensive monitoring of high-speed services that the Commission can insure its fulfillment of both the spirit and letter of Section 706.

V. TECHNICAL ASPECTS OF MONITORING

The Internet is a large, complex system. There is no simple measure of its performance. While the everyday notions of "speed" and "reliability" can be applied to the Internet, each of these terms derives from multiple dimensions of service quality. Speed, for example, may sometimes refer to the bandwidth of a connection; at other times it may refer to propagation delays, or latency. Even the variability of latency may affect perceived notions of speed. "Reliability" can refer to availability—is the network functional or not—or it can refer to data loss or the variability in the quality of service being delivered.

The multiplicity of dimensions of service quality belies the facile speed claims made by cable modem and DSL service providers. Virtually the only information consumers can use to choose

among high-speed data services is a data rate advertised by the provider—a rate that the user is likely to experience only occasionally, if ever.

Unlike end users, network administrators have at their disposal a wealth of data about the status of their own networks. Most network operators consider such information proprietary, however. They are not willing to release detailed operational data to customers, not to mention competitors. Moreover, network operators have incentives to be less than candid about the operation of its network—if they have sold a service claiming 2 Mbps to their customers, those customers might be unhappy to learn that they experience substantially lower data rates during the popular evening hours.

We propose a performance monitoring program for high-speed networks to redress the asymmetry of information in consumer markets and to assist the Commission in policy making. We suggest a system of hardware and software agents to measure the performance of the network from points at which outsiders have access to the network—namely, at the user's computer.

By limiting observations to the edge of the network, we lose a great deal of ability to detect and diagnose problems in service quality. But such information is, and arguably should remain, proprietary information, managed by facilities owners. Despite the limitations of edge-of-the-network measurements, they do take place where the user experiences the network. Thus, data gathered at the edge of the network are valid for characterizing the behavior of access networks.

VI. TYPES OF INFORMATION THAT CAN BE GATHERED THROUGH MONITORING

The options for measuring the quality of service offered over high-speed networks fall into two categories: packet level observations and 'holistic,' application-level tests. Packet-level tests rely on common Internet test applications. Basic network diagnostic tools as ping and traceroute report the responsiveness of hosts and delays along paths through the Internet. Both ping and traceroute provide low level, reliable information about the performance of the network. They are especially useful for monitoring changes in the responsiveness of the network at different times. A brief description of these tools will suggest how they might contribute to a QoS-monitoring program.

The ping program sends Internet protocol test messages to remote servers to determine if they are reachable. The program notes the amount of time that it takes for the response from the remote host to arrive. The elapsed time includes raw propagation delays, routing and switching delays, and processing delays on the remote host. If the path between two hosts remains constant, differences in response time reflect either varying loads on the remote host or, most likely, variance in the routing delays through the network.

The traceroute program reveals the path that packets take from the user's computer to remote servers. The program also indicates the amount of time currently required for each leg of the journey, usually in terms of an average taken over some small number of attempts to traverse the network. Results from the traceroute program can help diagnose routing problems, as well as

indicate how end-to-end delays are distributed across the individual legs of the journey from the user's computer to distant servers.
While packet-level tests are a valuable component of any performance data-gathering, it is not always clear how changes measured at the packet level translate into the quality of service experienced by users.

A set of holistic, application-level quality of service measurements would complement the packet-level data and would indicate more realistically the level of performance perceived by the average user. For example, to estimate the quality of service experienced by a person surfing the web, why not measure the download times of a mixture of commonly accessed and obscure web pages? Or to evaluate the quality of email service, why not send and receive email and record the rate at which email can be exchanged?

Subscribers to high-speed access services would be invited to participate in the monitoring program. They could be offered cash and/or access to value-added information about their own Internet connection as incentives for participating in the program. A background or "daemon" application running on a large sample of participants' machines could perform both the packet level and application level QoS tests. The daemon application would regularly measure the response time of a selection of sites on the web, archive the data, and periodically upload a report to a central monitoring server. The server would then aggregate and process information collected by all the participants in the monitoring program. The daemon application can be designed to minimize the extent to which it interferes with the user's activities by, for example, waiting for a lull in user before attempting to place a heavy load on the network connection input. (The daemon could, for example, wait for no keyboard or mouse input for a few minutes before running tests.)

The data gathered by a QoS-monitoring daemon application would demonstrate whether facilities-based providers were providing fair and equitable access to competing service providers. Any judgment based on such data would have to allow for disparities in response time dictated by technical constraints, of course. Also, the behavior of any Internet connection varies from moment to moment, so judgements based on repeated observations by multiple users' computers would be necessary to filter random variations out of the quality measurements.

VII. CALIBRATING MEASUREMENTS WITH PERCEPTIONS OF QoS

Ultimately, humans decide whether the level of performance being delivered over a network connection is adequate. It would be necessary, therefore, to conduct user studies to determine the subjective effect of objective delays in the network. It may be the case, for example, that most users would not notice an increase in network latency from 100 to 150 ms, but an increase from 250 to 275 ms might be enough to frustrate users. The subjectively perceived delays might vary from application to application, and so therefore a periodic study of consumer reactions to varying levels of QoS for a mix of currently popular applications would enhance the Commission's use of monitoring data for assessing the substitutability of access services.

VIII. COMPLIANCE & EXISTING TRIALS

Compliance realizes regulation. For independent commissions, compliance with their rules and regulations implements the public interest.

Monitoring of and mandatory disclosure of service quality are readily compliable. Much of the data exists or can be measured. Information services enterprises can attest to or document policies. Disclosure of quality of service provides high-speed enterprises with opportunities to demonstrate competitive advantage with rivals within their industries as well with rivals deploying other high-speed platforms. In so doing, monitoring and disclosure of high-speed service quality comprise incentives to high-speed industries to compete on service quality for the betterment of consumers.

The cable industry, in particular, has demonstrated leadership in high-speed trials. Currently, incumbent facilities-based providers of high-speed services are experimenting with the provision of high-speed services through multiple ISPs. AT&T is conducting high-speed access trials using ten different ISPs from November 2000 until April 2001 in the Denver, Colorado area. According to news reports, these trials enable consumers to select ISPs on the basis of comparative information about certain service quality measures. In many ways, monitoring and disclosure of service quality build on already existing industry initiatives like the cable industry experiment in Colorado.